

## PAHs and Smoked Foods

1: Adv Drug Deliv Rev 1997 Sep 15;27(2-3):129-159

The effects of diet, aging and disease-states on presystemic elimination and oral drug bioavailability in humans.

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Presystemic metabolism occurring in the intestinal epithelium and/or liver is frequently an important determinant of drug bioavailability after oral administration. Several factors are potentially involved in such a first-pass effect and their modulation may significantly contribute to intra- and interindividual variability in a drug's plasma concentration-time curve. For example, macronutrient intake and nutritional status may alter cytochrome P-450 (CYP) metabolism by the liver, and food per se in the form of a meal can also affect the first-pass metabolism of some drugs. More important changes, however, result from micronutrients and non-nutrients present in food. In the case of charcoal-broiled and smoked foods, polycyclic aromatic hydrocarbons formed during their preparation result in the induction of xenobiotic metabolizing enzymes, especially those regulated by the Ah-receptor, e.g. CYP1A, which are localized in the intestinal tract. A similar effect also occurs following the ingestion of cruciferous vegetables like brussels sprouts and cabbage, which contain indole-related phytochemicals. Such induction can markedly reduce a drug's oral bioavailability. By contrast, the glucosinolate breakdown products of other vegetables produce inhibition of drug metabolism. In the case of phenethyl isothiocyanate-containing watercress, CYP2E1 activity is markedly impaired; however, other organo-sulfur compounds present in, for example, garlic appear to have essentially no effect on drug metabolism. Constituents of grapefruit juice also result in reduced first-pass metabolism, especially for drugs that are CYP3A substrates. Again, this dietary effect is more pronounced in the intestinal epithelium than the liver. A similar, but more generalized, phenomenon also appears to be associated with eating piperine- and capsaicin-containing spices. Possible future applications of such metabolic inhibition include the use of active phytochemicals as bioavailability enhancers for drugs exhibiting a large first-pass effect, and also as cancer chemoprotective agents where CYP-mediated procarcinogen activation is a critical initial step in carcinogenesis. Aging results in a number of physiological changes that potentially can alter drug metabolism and presystemic elimination. By far the most important of these is a reduction in drug metabolizing enzyme activity. Unfortunately, the extent of this effect appears to be unpredictable, both with respect to a specific drug as well as a particular individual. However, the greatest age-related change in oral bioavailability and plasma concentrations is likely to occur with drugs that exhibit a significant first-pass effect (>80%) in young subjects. A similar situation also appears to apply when liver disease is present, especially when this is severe. A further complication in such patients is the presence of vascular shunting, which leads to drug-containing blood by-passing functional enzymes. As a result, plasma levels of drugs that normally exhibit marked first-pass metabolism may be many-fold higher in cirrhotic patients compared to those with normal liver function.

b  
cauliflower  
turnips  
mustard  
greens  
kale  
collards

PMID: 10837555 [PubMed - as supplied by publisher]

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2: Gig Sanit 1998 Sep-Oct;(5):22-5 ..

[Carcinogenic effects of the curing smoke]

[Article in Russian]

Kim IN, Kim GN.

A list of the carcinogenic substances contained in the fume used in the production of smoked fish and its products is presented. The level of benz(a)pyrene in the smoked foods generally corresponds to the international standards, but it is hundreds times higher in hot-smoked small fish. The cancer risk of smoked products may be reduced in the production of slightly smoked foods or when liquid-smoke devices are used.

PMID: 9816780 [PubMed - indexed for MEDLINE]

3: G Ital Med Lav Ergon 1997 Oct-Dec;19(4):137-51

[The toxicology and prevention of the risks of occupational exposure to aromatic polycyclic hydrocarbons. II. Toxicology. Exposure assessment. Environmental and biological monitoring]

[Article in Italian]

Apostoli P, Cassano F, Clonfero E, Dell'Omo M, Fiorentino ML, Izzotti A, Minoia C, Pavanello S, Valerio F.

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The evaluation of exposure to polycyclic aromatic hydrocarbons (PAH) should firstly comply with current regulations (D.Lgs. 626/94), that is, identify the compounds and exposed subjects, quantify exposure, adopt preventive measures and health and epidemiological surveillance. Environmental monitoring should take into account the technological cycle and the tasks with higher PAH exposure risk, and the main sources of emissions. In the case of skin contamination, it should be considered the measure of skin PAH by means of sampling or removal techniques; moreover, the determination of urinary hydroxypyrene (1-HP) should be performed. It is mandatory to analyse (Benz[a]) anthracene; Benzo[b]fluoranthene; Benzo[j]fluoranthene; Benzo[k]fluoranthene; Benzo[a]pyrene; Dibenzo[a,h]anthracene, i.e. the PAH marked with the R45-R49 phrase. When 1-HP determination is planned, Pyrene should be added. Biological monitoring has been addressed mainly to hydroxylated metabolites of pyrene and among these 1-HP, the main metabolite of pyrene, although non occupational factors, such as tobacco smoking and consumption of smoked foods are potentially confounding. Urinary mutagenicity tests which are heavily influenced by non occupational factors such as tobacco smoking and diet are not advisable. The determination of DNA and protein adducts is a promising test for evaluation of metabolic active dose but at the moment it is not suitable for routine use in occupational medicine. In order to interpret environmental and biological data, it will be useful to consider appropriate reference values ("limit" "guide",

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"operative", "maximum admissible") such as 0.1 mg/m<sup>3</sup> for total PAH extracted with benzene, 5 micrograms/m<sup>3</sup> for the mixture of 15 PAH listed by US NTP, the limits varying from 0.1 to 5 micrograms/m<sup>3</sup> for Benzo[a]pyrene, and 2.7-4.4 micrograms/g creat, for 1-HP.

Publication Types:

Review

Review, Tutorial

PMID: 9775008 [PubMed - indexed for MEDLINE]

4: Food Chem Toxicol 1997 Feb;35(2):213-8

Direct mutagenicity of the polycyclic aromatic hydrocarbon-containing fraction of smoked and charcoal-broiled foods treated with nitrite in acid solution.

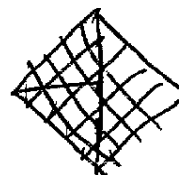
Kangsadalampai K, Butryee C, Manoonphol K.

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The polycyclic aromatic hydrocarbons (PAH) containing fractions of smoked and charcoal-broiled foods, namely, <sup>cod</sup>Sheat fish (*Kytopterus apogon*), Mimrow (*Crossocheilus reba*), Freshwater catfish (*Clarias batrachus*), chicken wings, rice pork sausage and pork, in addition to naphthalene, acenaphthene, anthracene, phenanthrene, fluorene, pyrene, benz[a]anthracene, naphthacene, benzo[a]pyrene, benzo[e]pyrene, 9,10-dimethyl-1,2-benzanthracene, dibenz[ah]anthracene, benzo[ghi]perylene and coronene, were evaluated for their mutagenic potential using *Salmonella typhimurium* strains TA98 and TA100 in the absence of metabolic activation after being treated with nitrite (500 mM) for 4 hr at 37 degrees C and in acid solution pH 3.0-3.5. The presence of N-nitroso compounds was also determined. Results showed that nitrite could convert most samples to direct-acting mutagens towards both strains except for fluorene and benzo[ghi]perylene, which exhibit mutagenicity only with TA98. It was demonstrated that treatment of PAHs with nitrite in acid solution produced some non-N-nitroso direct-acting mutagens, suggesting that they might belong to nitro-PAHs. Therefore, the consumption of charcoal-broiled and smoked foods simultaneously with nitrite is not recommended.

PMID: 9146734 [PubMed - indexed for MEDLINE]

~~Foods~~ <sup>cod</sup> ~~cont~~  
processed/deli  
meats



5: Prog Food Nutr Sci 1985;9(3-4):283-341

Diet, nutrition, and cancer.

Palmer S.

Evidence pertaining to the role of dietary factors in carcinogenesis comes from both epidemiological studies and laboratory experiments. In 1982, the Committee on Diet, Nutrition, and Cancer of the National Research Council conducted a comprehensive evaluation of this evidence. That assessment as well as recent

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epidemiological and laboratory investigations suggest that a high fat diet is associated with increased susceptibility to cancer of different sites, particularly the breast and colon, and to a lesser extent, the prostate. Current data permit no definitive conclusions about other dietary macroconstituents including cholesterol, total caloric intake, protein, carbohydrates and total dietary fiber. Specific components of fiber, however, may have a protective effect against colon cancer. In epidemiological studies, frequent consumption of certain fruits and vegetables, especially citrus fruits and carotene-rich and cruciferous vegetables, is associated with a lower incidence of cancers at various sites. The specific components responsible for these effects are not clearly identified, although the epidemiological evidence appears to be most consistent for a protective effect of carotene on lung cancer and less so for vitamins A and C and various cancer sites. The laboratory evidence is most consistent for vitamin A deficiency and enhanced tumorigenesis, and for the ability of various nonnutritive components in cruciferous vegetables to block in-vivo carcinogenesis. The data for minerals and carcinogenesis are extremely limited, although preliminary evidence from both epidemiological and laboratory studies suggests that selenium may protect against overall cancer risk. Frequent consumption of cured, pickled, or smoked foods, possibly because they may contain nitrosamines or polycyclic aromatic hydrocarbons, appears to increase the risk of esophageal or stomach cancer, however, the specific causative agents in these foods are not clearly identified. Excessive alcohol consumption among smokers appears to be associated with an elevated risk of cancers of the oral cavity, esophagus, larynx, and respiratory tract. The mechanisms of action of dietary factors on carcinogenesis are poorly understood. The NRC committee, and more recently, the National Cancer Institute and the American Cancer Society have proposed interim dietary guidelines to lower the risk of cancer. These guidelines are consistent with general dietary recommendations proposed by U.S. government agencies for maintenance of good health. (ABSTRACT TRUNCATED AT 400 WORDS)

Publication Types:  
Review

PMID: 3010379 [PubMed - indexed for MEDLINE]

6: J Natl Cancer Inst 1983 Jun;70(6):1151-70

Diet, nutrition, and cancer: interim dietary guidelines.

Palmer S, Bakshi K.

The Committee on Diet, Nutrition, and Cancer of the National Academy of Sciences recently evaluated the role of diet in carcinogenesis. Both epidemiological and laboratory evidence suggests that a high intake of total fat increases susceptibility to cancer of different sites, particularly the breast and colon. In epidemiological studies frequent consumption of certain fruits and vegetables and in laboratory experiments some components of fruits and vegetables, especially cruciferous vegetables, appear to decrease the incidence of cancers at various sites. In contrast, frequent consumption of salt-cured, salt-pickled, or smoked foods, possibly because they may contain nitrosamines or polycyclic aromatic hydrocarbons, appears to increase the risk of esophageal or stomach cancer. Excessive alcohol consumption among smokers appears to be associated with an elevated risk of cancers of the oral cavity, esophagus, larynx, and

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respiratory tract. Interim dietary guidelines to reduce the risk of cancer were proposed in accordance with these conclusions. No definitive conclusions were reached for other dietary factors, including total calories, cholesterol, fiber, and selenium, nor could the quantitative contribution of diet to overall cancer risk be estimated.

PMID: 6574285 [PubMed - indexed for MEDLINE]

7: Z Gesamte Inn Med 1982 Mar 15;37(6):169-76

[Relationship between nutrition and tumor formation]

[Article in German]

Kolb E.

The tumours of man mainly develop under the influence of the long-term intake of carcinogens and cocarcinogens. There is a correlation between the level of the intake of meat and the development of tumours of the colon and the mamma. In vegetarians these forms of tumours very rarely appear. For their prevention it is necessary to decrease the consumption of sorts of meat and sausage rich in fat, so that less than 50 g of animal fat are taken in a day. It is to be recommended an increase of the consumption of food-stuffs rich in raw fibers. The caratenes, the vitamin A and the vitamin-A-acid proved as anticarcinogens. In smokers an intake of carotene and vitamin A which overwhelms the need is useful. With smoked food-stuffs in small quantities benzpyrene and nitrosamines are taken in, a restriction of the consumption of smoked meat and fish is not to be recommended. a carcinogenic effect have also aflatoxines, for which purpose no food-stuffs infested by fungi must be taken in.

Publication Types:  
Review

PMID: 6283750 [PubMed - indexed for MEDLINE]

8: Bibl Nutr Dieta 1980;(29):57-64

Smoked food and cancer.

Fritz W, Soos K.

Smoking is a well-known source of food contaminated caused by carcinogenic polycyclic aromatic hydrocarbons. Epidemiological studies indicates a statistical correlation between the increased occurrence of cancer of the intestinal tract and the frequent intake of smoked foods. As observed during the last 10 years in a certain district of Hungary with a Slovenian population, the percentage of stomach cancer among all types of cancer is nearly twice as high (47-50%) as in Hungary altogether (29.9%). In this special district, predominantly home-smoked meat products are consumed. Using identical techniques, the authors investigated the contamination of smoked foodstuffs by carcinogenic, cocarcinogenic and other polyaromatic hydrocarbons in the German

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Democratic Republic and in Hungary. No significant differences have been found either in the average values or in the ranges of the benzo(a)pyrene (BaP) contents in meats smoked by industrial processes used in the GDR and in Hungary. In the GDR, industrially smoked foods contain on average 0.43 micrograms/kg, products smoked in handicraft workshops 0.76 micrograms/kg, home-smoked products 0.74 micrograms/kg. The mean BaP content of all smoked meat and sausage products amounts to 0.55 micrograms/kg. In Hungary, the following average values have been found: 0.6 micrograms/kg for industrially smoked products, 0.74 micrograms/kg for home-smoked products, the total being 0.7 micrograms/kg. The average BaP value of home-smoked (softwood) products of the Slovenian population in Hungary is as high as 4.16 micrograms/kg. Apart from this particular case, the techniques used in both countries permit the production of smoked meat and sausages with a BaP content of less than 1 microgram/kg.

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